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WHAT IS TERRA ALBA?

By Charles H. LaWall.

For many years previous to the passage of the Federal Food and Drug Act of June 30, 1906, the substance terra alba had been associated with confectionery in the sense of its being an adulterant and cheapener. In the popular mind as well as among chemists it conveyed the impression of a white, insoluble and tasteless earthy substance (terra alba L., white earth) which could be used as a filler and cheapener in candy. Where the idea of the prevalence of its use originated it would be difficult to say. It may be true that it was occasionally used by unscrupulous manufacturers, just the same as sugar may have been adulterated with sand by some grocers, but so far as any authenticated instances of either of these forms of adulteration having been detected by any person of authority, who afterward made a record of the fact, they are conspicuous by their absence in the literature of foods and food adulteration.

In the Federal Act before mentioned terra alba is one of the several adulterants which are specifically prohibited by name in the following clause:

> "An article of food shall be deemed to be adulterated, in the case of confectionery, if it contain terra alba, barytes, talc, chrome yellow, or other mineral substances."

This specific prohibition of terra alba by name is also found in the State laws of Alabama, Arkansas, California, Colorado, Connecticut, Florida, Georgia, Idaho, Illinois, Iowa, Kansas, Louisiana, Maine, Maryland, Minnesota, Missouri, Montana, Nebraska,

Nevada, New Hampshire, New Jersey, New York, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Utah, Vermont, Virginia, Washington and Wyoming. No interpretation of this clause or ruling in which these substances are specifically defined could be found in any of the foregoing instances.

One would naturally suppose that the identity of a substance which is referred to by name in so many laws could be easily established by referring to chemical authorities or general works of reference, but such is not the case.

I recently had the question put to me directly "What is terra alba?" and having answered it in my own mind, off hand, as being powdered gypsum, I set about confirming this opinion and soon found it no easy task, for not only did I find that a large number of authorities make no mention at all of the substance in their indexes, but I found, what was still more disconcerting, that those who did mention it and attempted to define it, did not agree as to its identity.

The first authority I turned to was Wiley, "Foods and Their Adulteration," 1906, where it is defined as being talc. This is the only authority of the many consulted by whom talc is mentioned as a synonym for terra alba and this is probably an error or the two substances would not be mentioned separately in the clause quoted from the Federal Act.

The Century Dictionary (1906 and 1912) gives pipe clay as a synonym. This same statement is made in Gould's Medical Dictionary, 1908, in the Standard Dictionary, 1902, and in Lippincott's Medical Dictionary (Cattell), 1910. White clay is the synonym given in Dorland's American Illustrated Medical Dictionary, 1906, and in the National Dispensatory, 1908.

Gypsum is given as the synonym for terra alba in Thorpe's Outlines of Industrial Chemistry, in Allen's Commercial Organic Analysis, Vol. I, under Paper, 1910, in Bartley's Medical Chemistry, 1900, and in Witthaus' Chemistry, 1890.

In Kraemer's Pharmacognosy, 1910, the statement is made that terra alba is a compound of alumina, silica and magnesia. Merck's Index for 1907 (a price list) gives kaolin as being identical with terra alba.

In the hope that some light might be shed upon the subject in

connection with the classification of chemical substances for the tariff, a letter was addressed to the U. S. Treasury Department asking for a definition of terra alba. In reply, the Bulletin of the Treasury Department, issued in 1909, was received, attention being directed to the following paragraph, No. 693, "Terra alba not made from gypsum or plaster rock."

In Bulletin No. 13, issued by the U. S. Department of Agriculture in 1892, upon the subject of confectionery, the only mention of the substance is in the following sentence, referring to insoluble substances looked for in the 250 samples examined (but not found): "Terra alba, kaolin or other mineral substances."

By this time I had come to the conclusion that terra alba is a substance differing in its identity according to the particular industry in or purpose for which it is used and a search was commenced for some one authority who would recognize and record this fact. I was astonished to find the large number of books on chemistry, etc., and works of reference in which no mention whatever is made of terra alba in the indexes. These books included the following:

British Pharm. Codex, 1907.
U. S. Dispensatory, 19th ed., 1907.
King's American Dispensatory, 1859.
Arny's Principles of Pharmacy, 1909.
Remington's Practice of Pharmacy, 4th ed., 1906.
Hager's Pharmaceutical Praxis, 1907.
Parrish's Practice of Pharmacy, 1874.
Sadtler and Coblentz, Text Book of Chemistry, 1907.
Attfield's Chemistry, 1890.
Alex. Smith's General Inorganic Chemistry, 1906.
Wagner's Chemical Technology, 1904.
Thorpe's Dictionary of Chemistry.
Watts' Dictionary of Chemistry.
Sadtler's Industrial Organic Chemistry, 1912.
Molinari's Industrial Inorganic Chemistry, 1912.
Encyclopedia Britannica, 1911.
Johnson's Dictionary, 1877.
Worcester's Dictionary, 1894.
Ure's Dictionary of Arts, Manufactures, etc., 1860.
Spon's Encyclopedia of Industries, Arts and Manufactures, 1879.
Food Inspection and Analysis, Leach, 1904.
Koenig's Nahrung und Genussmittel, 1889.

This list of authorities and works of reference is by no means complete, but it illustrates the range of the search, which included every book that might possibly contain a reference to the subject.

At last two references were found in support of the view previously mentioned, that terra alba is not one but a number of substances. In the 21st annual report of the Connecticut Agricultural Experiment Station for 1897, page 34, was found the following statement in connection with the examination of some samples of confectionery (where again, no evidence of its presence was found in a number of samples examined): "Terra alba, literally signifying white earth, is a trade name for some cheap, tasteless and flavorless white substance in powder, which can be used as a make-weight adulterant. Pipe clay and gypsum are commonly sold under this name." The foregoing reference is not nearly so available nor so complete, however, as the following from Webster's International Dictionary, 1900:

"Terra alba (L. white earth) (Com.), a white, amorphous, earthy substance consisting of burnt gypsum, aluminum silicate (kaolin), or some similar ingredient, as magnesia. It is sometimes used to adulterate certain foods, spices, candies, paints, etc."

The later edition of the same authority (1910) gives practically the same information in a slightly different form, as follows:

"Any one of several white amorphous substances; as (*a*) gypsum, ground for pigment, (*b*) kaolin, used especially as an adulterant of paints, etc., (*c*) burnt alum, (*d*) magnesia."

The foregoing facts will probably be of interest to many who have already met or will at some time in the future meet this query. The variations and inconsistencies recorded in connection with the search illustrate the carelessness or incompleteness, or both, with which many works of reference are compiled.

The possibilities are almost infinite for a shrewd lawyer to take advantage of these differences and interpose technicalities as to the identity of the substance terra alba in a case where its presence is made the basis of a prosecution for adulteration. It would seem to be preferable to follow the example of the Pennsylvania State law in which the prohibition is made equally emphatic by the use of the general term "mineral substances."

THE RESINS AND THEIR CHEMICAL RELATIONS TO THE TERPENES.[1]

By George B. Frankforter.[2]

The closing years of the eighteenth and the beginning of the nineteenth centuries found chemists engaged in the study of chemical problems related to both plant and animal life. Organic chemistry during this early chemical epoch was exactly what its name implied, a study of those substances which are produced through life processes, either plant or animal. During this early epoch, the problems in plant chemistry were more inviting to the chemist than those in animal life, first, because the compounds appeared to be simpler substances and, second, because they crystallized more readily and were therefore more readily obtained in pure form. As a result of these characteristics, early organic chemistry was largely confined to plant life, consisting, however, of little more than the simple preparation of the substances themselves.

Scheele was the first to point out that the plant and animal world is made up of definite compounds, just as is the inorganic world. He proved the assertion by isolating a number of organic substances, among them tartaric, citric, malic and uric acids. He even went so far in his study of the organic compounds as to suggest what the modern physiological chemist calls metabolism, as a means of explaining certain physiological processes. Owing, however, to the extreme difficulty in obtaining physiological compounds in crystalline form, Scheele devoted much time to phytochemistry, discovering more than a score of important plant compounds besides those mentioned above. Other men followed in his footsteps and by the beginning of the last century many of the important plant compounds had been isolated.

At the very beginning of what may be justly called the renaissance in organic chemistry, Marggraf (1745–79) completed

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[1] Reprinted from *Science*, N. S., Vol. XXXVI, No. 922, Pages 257–263, August 30, 1912.

[2] A part of the address of the vice-president and chairman of Section C, American Association for the Advancement of Science, Washington, December, 1911.

his historical work on the common beet-root. With his discovery and preparation of sucrose from the sugar-beet began the first and perhaps the greatest and most highly technical industry of modern times. It was likewise during the close of this first epoch that Pelletier began his classical work on the alkaloids, resulting in the discovery of no less than twelve of the important ones, including quinine, strychnine, and brucine. In fact, it was during this same epoch that nearly all of the great families of plants were studied from the chemical point of view, resulting, in almost every case, in important discoveries. Even the resins, which chemists have until recently regarded as too complex to deserve serious attention, were studied in an industrial way and more than thirty different varieties prepared and used in the arts. But the resins were only one of the many groups of organic compounds regarded as too complex to admit of other than a study in the most general way, for organic chemistry had not advanced far enough to permit of a thorough chemical study of even the simplest of the organic substances. The adoption of the radical and the ring theories about the middle of the last century, however, completely changed the sphere of organic chemistry and synthetic methods and the chemical constitution of organic compounds became the goal toward which a large majority of chemists worked.

The adoption of the benzene ring theory, together with the working out of the chemical constitution of naphthalene, pyridine, quinoline and the terpenes, opened new fields in phytochemistry, and the first ten years of labor after the adoption of these new theories showed amazing results.

Structural and synthetic work in plant chemistry really began in the sixties. In 1869, Lieberman startled the whole chemical world by synthesizing alizarine, an important vegetable dye-stuff, and shortly after the alizarine synthesis, Baeyer succeeded in building up the indigo molecule.

Following these historical discoveries came numerous pyhtochemical syntheses, one of the most important being the artificial preparation of vanillin. Until Tiemann had shown that vanillin can be made cheaper in the laboratory than it can possibly be obtained from the vanilla plant, chemists, on the whole, were somewhat skeptical about the practicability of synthetic methods and especially as to the possibility of these synthetic compounds sup-

planting those produced by nature. The vanillin and the indigo syntheses, however, completely changed the whole chemical world in this respect. Men began to imitate nature in the building up of not only the vegetable, but also the simple animal compounds —a few enthusiasts casting longing glances at the constitutional formulæ of sugar, starch and cellulose, while the ultrachemical investigators dared even to speak in undertones of the structure of the albumins and the resins. Then came Baeyer's marvellous work on mellitic acid. His exhaustive study of this acid, which began as early as 1867, was so far reaching in its application to the ring compounds that it had much to do with final working out of the structural constitution of the terpene group.

There is a universal feeling, I think, among those who have watched the development of organic chemistry during the last twenty years, and especially along phytochemical lines, that in the not distant future all of the more important plant compounds will have been products of the laboratory. That there is ground for such a statement is borne out by what has already been done. The investigations of Loew, Butleroff, Kiliani, Emil Fischer, and Wohl on the carbohydrates are so familiar to every one that it is only necessary to briefly refer to them at this time. The aldehyde condensation reaction by Loew and Butleroff, the building up of the sugars by Kiliani and the down-building by Wohl make the synthesis of the hexoses an established fact and the synthesis of the bioses at least a possibility in the near future.

The briefest phyto-synthetic review would be incomplete without referring to the most recent work of Emil Fischer and his pupils on the so-called polypeptides. Here is a group of complex substances belonging to the albumins of both the plant and the animal world, a group of compounds whose synthesis has, until recently, been regarded by many as beyond human possibility. Nevertheless, Fischer has built up the complex polypeptides until the artificial molecules are equal in size to the albumins themselves, leaving the synthesis of these complex chemical substances no longer in the list of vain possibilities.

Of scarcely less importance in the phytochemical world than the carbohydrates, the alkaloids and the albumins, are the resins and terpenes. Wallach has presented a satisfactory constitutional formula for pinene, but the resins are still classed with substances

of unknown constitution. Notwithstanding the fact that less is known concerning the chemical nature of the resins than perhaps any other group of organic compounds, they are doubtless the oldest organic compounds known to man. They played an important part in the chemical industries in the early history of mankind. They were used in almost every phase of early human life, as lacs, varnishes, balsams, perfumes, pomades and in the art of embalming. They were described by the early alchemists as substances insoluble in water, generally soluble in alcohol, and for the most part non-crystallizable. They are the result of secretive plant fluids, exuding from the plants and hardening in the air. They could not be separated into their constituents by any means known to the early chemists, and were therefore regarded as single substances. As a rule, however, they are mixtures of two or more complex substances, a gum and some volatile oil or terpene. They were known as gum resins or natural balsams and with the terpenes as oleoresins. As a result of their non-crystalline nature they were generally excluded from the list of substances worthy of investigation.

That there is a close chemical relationship between the resins and the terpenes, there can be no doubt, notwithstanding the fact that there is comparatively little experimental evidence to prove the assertion. One of the reasons usually given for the assumption is based on the fact that the resins and terpenes generally occur together in plants. This is by no means important evidence, for it frequently happens that entirely different groups of organic compounds are intimately associated with each other in both plant and animal life.

Notwithstanding the fact that considerable general industrial work has been done on the resins, especially those of the pine family, yet no one has been able to determine with certainty the molecular constitution of any of them, not even of abietic acid, the most common and the most important of all of the resin acids. Not only are the structural formulæ unknown, but in most cases the empirical formulæ are still in doubt. For instance, the formula for abietic acid has been generally accepted as $C_{20}H_{30}O_2$, but Mach in his dissertation on the acid gave to it the formula $C_{19}H_{28}O_2$. Absolutely nothing is known of its chemical constitution.

Various theories have been advanced concerning the relation-

ship between the resins and terpenes. What evidence there is may be briefly stated. The fact that the aldehydes in the presence of alkalies change to resinous matter was presented by Wiesner in what may be called the reduction theory. Wiesner[3] assumed that the resins are formed from the carbohydrates, or, speaking more specifically, from the starches by a process of polymerization and reduction. It is perfectly evident that Wiesner's theory is not applicable in all cases. The pine family, for instance, contains a minimum amount of starch, yet it is the richest of the resinous species. Wiesner was aware of this fact and assumed that in the case of the pine family the resins were formed through the action of gallic and gallo-tannic acids.

While the starch theory has certain facts in its favor, there are, on the contrary, serious objections to it. It would seem not only strange, but also diametrically opposed to general chemical laws, that plants should proceed to build up the complex starch molecule and then break it down again into the resin and finally into the terpene molecule. Of course, it must not be forgotten that the sugars belong to the aldehydes and tend to form resinous substances when treated with alkalies. They are, however, by no means as readily converted into the resins as the simpler aldehydes. One would naturally expect that if the resins are formed by the aldehyde reaction they would proceed from the simple rather than from the complex aldehydes or sugars.

One of the first comprehensive works on the formation of the resins from the aldehydes was presented by Baeyer. He obtained several synthetic resins by the aldehyde condensation reaction, but an examination showed that they were unlike any of the resins found in nature. In each case the molecule seemed to be extremely complex and no attempts were made to determine the structure or the size of the molecule. Kronstein, following out the work which Baeyer had begun, presented constitutional formulæ for these aldehyde resins in a very unique but entirely empirical way. He assumed the resin molecule to be a complex benzene ring or perhaps several superimposed rings joined with either hydrocarbon, methoxyl, ethoxyl or carboxyl radicles, and gave the graphic formulæ for them. Of course such structural formulæ

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[3] *Centr.*, 1865, p. 756.

are interesting, but needless to say they are not based on experimental data.

In the starch explanations of the formation of the resins in plants, it must be assumed that the resins are formed by first building up the complex starch molecules from the simpler aldehydes, and then breaking them down again into the resins and terpenes. So far as can be ascertained there are no experimental data in favor of this theory. If, on the contrary, we assume that the resins are built up from the simple aldehydes, the process is more logical, as it only requires two steps, namely, polymerization and reduction, instead of three distinct steps as indicated in the following simple diagram:

$$\begin{tikzcd}[column sep=small] & \text{Starch} \arrow[dr] & & \\ \underset{\text{(Formaldehyde)}}{\text{Aldehydes}} \arrow[ur] \arrow[rr] & & \text{Resin} \arrow[r] & \text{Terpenes} \end{tikzcd}$$

While the above theories have many points in their favor, there is another which, while it may have some objections, has at the same time decided advantages over the starch or reduction theory.

It is common knowledge that the terpenes, when exposed to air, slowly change to complex polymers and resins of unknown composition. The principle involved is doubtless condensation followed by oxidation. Wöhler was the first to suggest that the resins may be built from the terpenes by the above-mentioned condensation and oxidation process. He based his assumption on the well-known fact that turpentine absorbs oxygen, forming a resin. This oxidation process may be represented by the following equation:

$$2C_{10}H_{16} + 3O = C_{20}H_{30}O_2 + H_2O.$$

Wöhler, unfortunately, presented no experimental data. Later, Cailliots obtained a resin by the oxidation of turpentine with nitric acid. It was not well defined, however, and not identical with any of the common resins, although it bore some semblance of common pine resin.

Barth[4] obtained, by oxidizing oil of lavender, a terpene, an

[4] *Ann.*, 143-313.

amorphous resin which he carefully studied and gave the formula $C_{20}H_{30}O_3$, apparently an oxyabietic acid.

Heldt,[5] in an exhaustive study of the resins, produced common sylvic acid by oxidizing a polymerized form of turpentine according to the following equation:

$$2(C_{10}H_{16}) \text{ or } C_{20}H_{32} + O_2 = C_{20}H_{32}O_2, \text{ sylvic acid,}$$

and

$$C_{20}H_{32}O_2 + O = C_{20}H_{30}O_2 + H_2O, \text{ or abietic acid.}$$

This work has been repeated, but without obtaining either sylvic or abietic acids.

One of the most interesting communications along this line was presented by Bruylaut. He obtained, by a method not given, a polymer of pinene which he represented as a condensation of two molecules of pinene or dipinene. By oxidizing this substance he obtained an acid which had the empirical formula for abietic acid:

$$\begin{array}{l} C_6H_6 < \begin{array}{l} C_3H_7 \\ CH_3 \end{array} \\ \quad | \\ C_6H_6 < \begin{array}{l} CH_3 \\ C_3H_5O_2 \end{array} \end{array}$$

No details of the work, however, were given.

Work on the condensation of the terpenes has been in progress at the University of Minnesota for several years. Before describing some of these experiments, however, it may be of interest to briefly trace the work on the synthesis of the terpenes themselves. It was observed early in this work that when pinacone is treated with bromine, an extremely complex reaction takes place and among the products formed are isopropyl alcohol and substances belonging to the terpenes. It was found, however, on carefully studying the reaction, that Baeyer had already observed this fact, but had not followed out the reaction, doubtless on account of the extreme complexity of the reaction. If, however, we take into consideration these two substances, the reaction may be represented as follows:

$$6C_6H_{14}O_2 = 2C_3H_8O + 3C_{10}H_{16} + 10H_2O.$$

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[5] *Ann.*, 63–48.

Some time previous to this work, Kondakow[6] in his work on angelic and tiglic acids obtained from them a hydrocarbon which proved to be a methyl derivative of crotonylene. It had the general formula for the hemiterpenes. From the description it seems quite likely that this hydrocarbon is related to the terpenes, for it has the formula $CH_3 = C(CH_3) - CH = CH_2$, which is identical with the hemiterpene, isoprene.[7] Now, angelic and tiglic acids are comparatively common in the plant world and if, as Kondakow states, these hydrocarbons are readily obtained from the acids, then it is possible that the hemiterpenes are formed in this way and by the condensation of two molecules of the hemiterpenes, a terpene in this particular case, camphene, is formed according to the following simple equation:

$$2C_5H_8 = C_{10}H_{16}.$$

In pursuing the work of the terpene polymerization, practically all of the methods in the terpene literature were tried. All of them, however, were unsatisfactory. It was noticed in previous work on the chlorhydrochlorides[8] of terpenes, that in the preparation of the hydrochloride on a large scale there was always left a considerable portion of material of thick oil consistency after the chloride had been removed. Examination showed that this oil contained a small quantity of resinous matter. After unsatisfactory attempts to isolate the resin, other agents were tried. Bromine and iodine were tried and each was found to produce resins more readily than chlorine. As iodine gave best results, it was used in the experimental work which follows. It was found, first of all, that iodides somewhat similar to the chlorhydrochlorides could be formed, especially if the reaction took place in sunlight. These iodides were first isolated and studied. The di-iodide proved to be of special interest. When pure it is a heavy colorless oil with a slight camphoraceous odor. When exposed to sunlight it readily decomposes, liberating iodine and resins, notwithstanding the fact that sunlight seems to play an important part in its formation. If exposed to sunlight for some

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[6] *Jour. of the Russ. Phys. Chem. Soc.*, 1891, I., 178.

[7] It may be interesting to the reader to note that isoprene has very recently been polymerized to India rubber.

[8] *Jour. Am. Chem. Soc.*, 28, p. 1461.

time the iodine is all liberated and there is left a resinous mass composed chiefly of two substances. This resinous mass was subjected to distillation in vacuo. The distillate obtained was a thick, colorless, stable oil. Its molecular weight indicated a dipinene. It contained no iodine, and from its remarkable stability it is probable that the pinene radicles are doubly joined to each other. By oxidation it forms an acid isomeric with abietic acid. The residue left in the flask after the dipinene had been removed was also of unusual interest. It proved to be a solid of a light amber color. It had exactly the same melting point of ordinary rosin. Most of its properties were also identical with those of common rosin. It proved to be a tetra pinene, and, owing to its close resemblance to ordinary colophonium, it has been called colophonene.

These two condensed forms, the di- and the tetra-pinene compounds, have been isolated and carefully studied. Both are stable, but may be oxidized to acids with many of the characteristics of the resin acids. A comparison of these synthetic compounds with the natural resins is both interesting and important. Those which have been prepared and examined at the present time do not agree in every respect with the natural resin acids. This fact is not surprising, however, as any one of the different groups, occurring in the molecule when oxidized, would give a different acid. It would, therefore, be mere chance if the synthetic compounds should be identical with the common resin acid.

In summing up the experimental evidence in connection with the theories of the formation of the resins and terpenes and their chemical relationship, the following syntheses may, under different conditions, represent what takes place in certain phases of plant life:

1. The formation of the resins from the simple aldehydes.
2. The formation of the resins from the complex aldehydes or carbohydrates.
3. The formation of the resins from the terpenes.

It is not impossible that the resins are formed by any one of the above syntheses. There are abundant reasons for believing, however, that the synthesis of many of the resins is intimately related to the terpenes, that is, the terpenes may be first formed from simple compounds as the hemiterpenes, then converted into

the resins by condensation and oxidation. This reaction seems entirely in accord with the chemical changes which naturally take place as phytochemical changes usually proceed from the simple to the more complex, as for example, from formaldehyde to the carbohydrates, but never from the carbohydrates to formaldehyde.

From the study of these terpene derivatives, it seems more than probable that the resins, at least those of the pine family, bear the same general relationship to the terpenes that naphthalene does to benzene and that the terpene molecule, $C_{10}H_{16}$, is the common substance from which the resins are derived.

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SOME OF THE NEXT STEPS IN BOTANICAL SCIENCE.[1]

By CHARLES E. BESSEY.[2]

When one who has worked long in any field of science speaks before an audience such as this he is expected to say something about the condition of his branch of science when he began work with meager and poorly adapted apparatus, to contrast it with its greatly improved condition to-day, and to dwell with pride upon the finely equipped laboratories with costly apparatus especially designed for particular experiments, to be found by the twentieth century scientific student. And I must confess that the temptation to do so was one difficult to resist, for we who have grown old in years are fain to dwell upon the days of long ago with the garrulity which comes with gray heads and withering muscles. It has seemed to me wiser, however, that this evening we should look into the future rather than into the past, for in that direction lies the possibility of progress, and it is of progress that I wish to speak.

THE BOTANY OF YESTERDAY.

Yet in order that we may properly orient ourselves with reference to the area covered by the science of botany to-day, we shall have to go back a few decades to understand what additions have been made to its territory during this period of expansion. For the shrewd observer can not avoid the conclusion that botany has

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[1] Reprinted from *Science*, Jan. 3, 1913, pp. 1–13.

[2] Address of the president of the American Association for the Advancement of Science, Cleveland, December, 1912.

shared with the world powers in a territorial growth which has extended its boundaries far beyond those known to the fathers, and we have annexed much contiguous and even some remote territory in a most imperialistic fashion. It may be comforting to some people to know that during all this time there have been those who have constantly and consistently lifted up their voices in protest against this contravention of the practise of the fathers, and the breaking down and removal of the ancient landmarks. In all these years there have been botanical anti-expansionists, but like their brothers in the national field they have been overwhelmed, and the tide of expansion has swept on unchecked.

Consider for a few minutes the botany of forty years ago, when you could count on the fingers of one hand the American colleges that had chairs of botany. And here I use the term chair advisedly, for they were literally chairs and not departments, much less laboratories. And everywhere else in the colleges of the country the chairs of botany were represented by what Holmes so aptly called "settees" from the number of subjects taught therefrom. The botany dispensed from these chairs was the delightful study of the external morphology of the higher plants, especial emphasis being laid upon the structure of flowers and fruits. And it may truly be said here that often the teaching was done very well, far better than many a botanist to-day is wont to imagine. I am pretty sure that in general the teaching was as successfully done then as it is now. There were some poor teachers then as there are now, and there were some inspiring teachers then who touched their pupils with the sacred fire, as there are now some who have had a divine call to teach and inspire and help.

And with this external morphology there was always associated the classification of the higher plants, in its simpler form the pleasurable pastime of identifying the plants of the neighborhood, and in its more advanced form represented by the work of Torrey and Gray and Vasey and Engelmann. And we should judge the systematic botany of that day by the work of these masters and not by the diversions of its amateurs; and you will agree with me that so judged the systematic botany of that period will not fall short of any standard we have set up in these later days.

The botany of that day was not without its laborious investigations and its tangible results. Every new area was a great out-

of-doors laboratory to be diligently studied from border to border. That was the day of the founding of many small botanical gardens, and small local herbaria, some of which having served their purpose disappeared long since, while others have grown into the great and flourishing institutions of to-day.

This much as to the botany of the immediate past; the phase of the science in which the older living botanists were trained.

PRESENT-DAY BOTANY.

And what of the botany of to-day? Let us consider for a little the present condition of the science.

It is Unorganized.—The personnel of botany has greatly increased with the great increase in the territory it now includes. This personnel, it must be said, is still quite heterogeneous. Some of us are largely self-taught, so far as the major part of the subject is concerned. We brought to our work the results of the meager teaching of the old-time college class-rooms, and year by year we have enlarged the borders of our own departments as we have added to our own knowledge of the subject by means of our laboratories and libraries. Thus we have built all kinds of superstructures upon the foundations supplied by our teachers. As a consequence the science is yet largely unorganized and lacks consistency in plan and purpose. Here and there a dominant man has wrought out a scheme of the science for himself, but how familiar is the fact to all of us that there is yet no agreement even upon so small a question as to the content of the first year of college botany, or the mode of its presentation. There is moreover a vagueness as to the boundaries of the science, some botanical teachers wandering far across the border into the domain of some contiguous science, or still more commonly into the more or less practical applications of some portions of botany. This latter indiscretion is especially noticeable in the textbooks prepared for the secondary schools, in some instances by botanists of good standing. If this were done by the agriculturists, the agronomists, and horticulturists, the foresters and others in similar lines of work with plants, it would not be surprising, but when this is done by botanists it is significant of the unorganized condition of the science. With a fuller knowledge of the science there must come a clearer

vision of what it is, and what it is not, and we shall no longer find textbooks of botany made to include so much that is not botany, while leaving out so much that is botany.

This difference of opinion as to what constitutes botany results in the absence of united effort. In its simplest aspect it takes the familiar form of uncertainty as to the content and value of the work done by the student elsewhere when he transfers himself from one college to another. As a matter of fact there is yet no agreement as to what is a standard first-year's course in college botany. What teacher has not been sorely puzzled to know to what courses to admit men who came from another college with credits in botany! It is quite unscientific to try to account for this condition by an excusatory reference to the individual peculiarities and the personal differences of the teachers. In science we consider the personal equation as something to be determined and eliminated, and not to be excused and tolerated. Every difference in the treatment of, say the first-year course, is just so far an indication of a more or less unscientific attitude by one or all of the teachers concerned. We work in this haphazard, disconnected way either because we do not know any better, or knowing better we think it not worth while. Either horn of this dilemma is equally unworthy of our acceptance. Ignorance is no valid excuse for the scientific man, and in science everything is worth while. It is to our shame as botanists that we acknowledge our in ability hitherto to frame a standard first-year course in college botany. When the science is definitely formulated in the minds of botanists the present disagreement will no longer exist. Surely we now "see as through a glass darkly."

The Applications of Botany.—Again, it may be remarked that we are to-day placing great emphasis upon the applications of botany to some of the great human activities, especially to agriculture. Witness the agricultural experiment stations with their botanists of all kinds, from those who study weeds and poisonous plants, to the physiologists, pathologists, ecologists and plant breeders. And as we look over the work they do we are filled with admiration and pride that they have individually done so well. But it is not the cumulative work of an army of science, it is rather the disconnected, unrelated work of so many individuals. They are doing scientific work in an unscientific way. There is as

yet no movement of a united army of science; it has been rather a sort of guerrilla warfare against the common enemy. We lack organization, and like unorganized soldiers we make little headway in spite of individual learning and efficiency. Botanical science which should have guided and directed these laudable applications has not kept pace with them, and we have the spectacle of these economic botanists, physiologists, pathologists, plant breeders and others working apart from the botanists proper, and sometimes even disclaiming any allegiance to the parent science. Nothing but confusion and disaster can result from such a condition.

Lack of Co-operation.—Contrary to what is sometimes affirmed, botanists are still studying the flora of the country. In some quarters there has been expressed the fear that field botany has disappeared from the schools and colleges; but this is far from true. While it no longer claims the larger part of the student's attention, it is still an essential part of the training of every botanist, and it is probably true that in some cases there is even more field work required to-day of young botanists than its importance demands. Certainly in one kind of field work I should like to see some of the energy and ability now given to the discovery of means for splitting old species turned towards the solution of problems pertaining to growth, and development, and reproduction. But the careful field study of what plants grow here and there, and why they do so, is greatly to be commended. The sociology of plants, or as we call it, ecology, has given in the last few years a new reason, as well as a new direction to field botany.

The systematic botany of to-day continues to concern itself more with the distinction of species than with their origin, and this has brought to this department of the science an increased narrowness which has greatly injured its usefulness. On the other hand plant breeding, which should be the experimental phase of systematic botany, has had no connection with it. And strangely, systematic botany, which should welcome plant breeding as an ally in its quest as to the meaning and origin of species, has been scarcely at all interested. It has been left to the florists, the horticulturists and the agronomists to patronize the new phase of botany, and this they have done, in spite of the new and quite unnecessarily formidable terminology so rapidly developed by the breeders. So what might have proved to be one of the most helpful aids to the solution of the greatest of biological problems—how living things

have come to be what they are—is allowed to fret out its life by beating vainly against the technical bars of its Mendelian cage. I know of no better illustration of the unorganized condition of botanical science than this failure of the systematic botanists and the plant breeders to work together for a common end.

THE BOTANY OF TO-MORROW.

But I have dwelt enough upon the past and present, and I feel inclined to apologize to you for having turned your faces so long backward. For while we must consider what has been, we can make progress only by planning for what is to be. So let us turn now to the future of botanical science, and endeavor to trace its more profitable course of development during the next one or two decades. What are seemingly to be the demands of modern society upon this science? What are to be some of the next steps in its evolution? For whatever we may say in regard to the independence of science we can not escape the fact that it must serve its "day and generation." No science can hope for support or recognition that does not respond to the demands of its age. And yet we must not ignore the labors of those pioneers in every science who foresee possibilities that are hidden from the mass of men. There must always be place provided for the few seers who see to-day what is now hidden from mankind in general, and may continue to be so hidden for generations, or centuries. All honor to these prophets who prepare the way for the oncoming of scientific truth, but it is true, nevertheless, that it is only when such truth has permeated contemporary society that science thrives.

Its Content.—Looking forward, then, let us try to see the trend of that branch of science which deals with plants, the science which I have the honor of representing on this platform this evening. And my first inquiry may well concern itself with the content of botanical science in the immediate future. As we become better acquainted with it and recognize more clearly its relations to the activities of the community we shall be able to define its proper content with more accuracy. And let no man attempt to belittle the importance of such an undertaking. It is not useless to attempt to fix the boundaries of any field of human endeavor, especially in such a one as this which deals with so vast a number of individual objects, each having many possible relations to one another and to ourselves. I am well aware of the impossibility of absolutely

delimiting botany from every other science, and especially of doing so with reference to many of its applications, and I am fully aware of the fact that the limits of any science are subject to change with the progress of human knowledge. Now and then there must be a "rectification of the frontier" in respect to the boundaries of a science, as with the boundaries of a great empire, as its farther provinces and the exact location of rivers and mountain ranges become better known. So without doubt we shall have to add to or subtract from the area now allotted to botany; and yet I feel that it is worth our while to spend a little time in indicating its present boundaries and content.

With all the details that may be insisted upon by some specialists it still is true that the field of botany may be considered in three parts, structure, physiology and taxonomy. Beginning with such structures as are obvious to our unaided eyes we have carried our studies to the minute structure of the tissues, and the cells which compose them. We are able now to peer into the protoplasmic recesses of the living cell, and while we can not say that we have seen life, we have seen where life is, and what it does. Cytology, histology and morphology in our modern laboratories have greatly changed our conception of the structure of the plant. It is no longer made up of forms to be compared because of their general similarity of outline, or of position in the plant body. The plant as a whole is a community of variously differentiated living units, just as is each of its organs. It is a complex community in which there is a measure of individual independence of the units, along with much of mutual dependence.

This leads me easily to that portion of the field of botany that has to do with the activities of plants and their organs—physiology—whose scope has been so greatly extended in these later years. Here such inquiries as those pertaining to nutrition, growth, sensibility, reproduction are of primary importance. The introduction of the experimental method of inquiry has made this a favorite department of the science. Who does not enjoy catching a plant, tying it up in a corner and compelling it to do something, while we watch for the result? This kind of study appeals especially to those who are looking for demonstrations, and for this reason plant physiology has been increasingly popular. Some botanists indeed have gone so far as to insist upon giving first place to physiology, probably because of its ready appeal to our senses. It

is easy to interest a boy in the thing that responds, whether it be a kicking frog stimulated by an electrical discharge, or a green plant whose stimulation is a properly directed beam of sunlight. And yet it is well for us to remember that the plant is first of all a structure, whose complexity may well challenge the most acute minds. We find it far easier to record the responses of plants to our planned stimuli than to unravel a structural complex, and so no doubt we shall continue to entertain ourselves and our students with what are too often futile experiments.

In this part of the botanical field are pathology, which grew up from our observation that organs may not respond normally; ecology, which developed from the observation that plants tend to live in communities; and phytogeography, having to do with the means for and the results of distribution. There are signs that for economic reasons pathology may become rather sharply set off from physiology, of which it is properly a part, much as through the zeal and enthusiasm of the ecologists there was once the suggestion of a physiological schism. The latter is happily no longer imminent, and it may be hoped that it will not again threaten the unity of plant physiology. And so it may be hoped that the pathologists will not wholly secede from association with the physiologists.

Taxonomy, or as we used to call it, classification, occupying the third division of the field of botany, long received the almost exclusive attention of botanists. And even to-day it is the pretty general opinion of our non-botanical friends that we are constantly employed in collecting specimens, and in some intricate and mysterious way determining their classification and affixing to them their proper Latin names. And it must be admitted that every botanist does a good deal of just such work, quite as every chemist makes many analyses, and tries to arrange in orderly sequence the chemical substances which he has in his cabinet, and the astronomer classifies and names the heavenly bodies with which his science deals. At first even the botanists knew but few plants, just as now most men know scarcely more than a score. But as the botanists came to know a larger number of plants, it was imperative that they should be named, and then grouped conveniently for easier reference. Thus arose such crude, primitive classes as herbs, shrubs and trees, which served their purpose until the numbers became too great again, when additional structural differences were

brought in to help separate the large numbers into smaller groups. This was the earlier classification, based upon structure alone. It was taxonomy without doubt, and it was helpful, since it enabled us to arrange plants in an orderly fashion, but it ignored the fact that plants have ancestors, and that the plants of to-day are what they are through their inheritance of ancestral characters, accompanied by modifications peculiar to them alone. When, however, the doctrine of evolution came into botany it brought with it the idea of descent, and thereafter taxonomy included phylogeny. To-day the taxonomist is no longer content to stop with a knowledge of the structural differences between plants; he must know how this structure arose from that; he must know which is the primitive structure and which the derived. Phylogeny has so far entered into taxonomy that it has given new meaning to the work of the systematic botanist, and it is bringing into this department of the science something of the philosophical aspect which was nearly wanting heretofore. That this must be the direction of the development of the taxonomy of the future is without question, and we may look confidently for a marked expansion and enlargement of the phyletic idea in botanical taxonomy.

And here I may pause for a moment to advert to a part of taxonomy with which some biologists have little patience, without good reason, as it seems to me. I refer to the matter of taxonomic nomenclature which has vexed the souls of many botanists, especially during the past one or two decades. However, since every science must have its nomenclature it is childish for us to wish to ignore it in botany. It is a part of the science, and we must give it consideration if we are to do our full duty. I have been surprised many times when men have spoken disparagingly of the whole matter of nomenclature, and of those who are giving time and effort to its stabilization. While it may be granted that not every botanist is in duty bound to help to settle questions of nomenclature, or even to take part in framing the general rules of procedure, it is the duty of every one to appreciate and encourage those who are so engaged. It has sometimes seemed to me as I have heard wholesale denunciations of nomenclature and nomenclaturists that instead of being botanists we are only cytologists, morphologists, physiologists, pathologists, ecologists.

This contempt for nomenclatural questions is symptomatic of a much-to-be-deprecated state of mind, quite too common among

scientific men, especially those who have engaged in special lines of work. I believe in specialization in botany, but specialization should not degenerate into narrow bigotry. A wise man long ago admonished his friends in words which I am tempted to repeat here as most fitting:

> But now they are many members, but one body. And the eye can not say to the hand "I have no need of thee"; or again the head to the feet, "I have no need of you." Nay, much rather, those members of the body which seem to be more feeble are necessary; and those parts of the body, which we think to be less honorable, upon these we bestow more abundant honor, and our uncomely parts have more abundant comeliness; whereas our comely parts have no need: but God tempered the body together, giving more abundant honor to that part which lacked, that there should be no schism in the body, but that the members should have the same care one for another.

Wiser words of counsel for the workers in different parts of the field of a science were never written, and I beseech you, my botanical brethren, to heed them, "that there should be no schism in the body" of botany.

Personality of the Botanist.—Quite easily the foregoing leads to a consideration of the personality of the botanist of the immediate future. What manner of man will he be? What will be his training? In other words, what will the future demand of the botanist? For it does not need argument to show that the men engaged in botanical work in the future will be developed and fashioned in response to the demands of the community.

If I interpret aright the movement of modern society as a whole, it is going to result in a demand for two things that by many are thought to be opposite and antagonistic—specialization and breadth. The first it will demand of its experts, the men who are set aside to solve particular problems for the community. In most cases these will be economic problems of immediate importance to the community, but there is no reason why in the most intelligent communities they should not be scientific problems, of more remote importance. No doubt there will be a demand for many such experts, each of whose tasks will be restricted to but one problem. The only requirement laid upon these men will be that they can do the work to which they have been assigned, and the more restricted the problem the narrower may be the preparation of the expert. Such men will be demanded in increasing numbers by the scientific bureaus of the general government, by

the state experiment stations and by large private establishments engaged in beet growing, cane growing, fruit growing, potato growing, hop growing, etc., and it will be the duty of the teachers of botany to produce an adequate supply of such botanical experts.

But while the community is certain to increase its demand for botanical experts we must not overlook the fact that with this demand will come another, much more imperative, for men of far greater breadth and depth of knowledge, who in addition to training the botanical experts of various kinds for the community, are able to bring the science as a whole before the youth of the land as a part of the scientific culture which modern society requires. These must be men of the broadest training; men whose sympathies are not bounded by the one science which they know, much less by one phase of botanical science; men who, knowing well their one science, know also much of the related sciences; men who in addition to a knowledge of science bring to their students and their community the results of that broader view which relates botany to the life and activities of the community. Such men bear the name of botanists worthily, and justify the contention of scientific men that science may contribute more than material good to the community. These are Lord Bacon's "Lamps," and "Interpreters of Nature."

And my vision is by no means unrealizable. Already among botanists there are those who measure up to this ideal. Already there are those who to a wide and deep knowledge of plants add that breadth of culture that brings them into sympathetic relations with the company of scholars throughout the world. As I speak these words there will come to you the names of those of our number who are known and honored as botanists, but whose beneficent influence extends far beyond the limits of their science. And I am confident that this high standard, now reached by some, will be demanded for all by the community of the future. Such botanists will be the leaders of their students, guiding wisely their early steps in science; they will be the leaders of the experts whose results they will be able to relate to other parts of the botanical field; and they will be the leaders of the community, not only in the applications of botany to the solution of material problems, but in a larger and nobler manner they will be able to help them in the higher things that make for culture and spiritual uplift.

The Teaching Institutions.—Turning now to the institutions of

learning—the colleges and universities—where botany holds a place as one of the sciences, let us ask what we may look for in regard to its development. In every proper college the department of botany exists primarily for its teaching function, and this is true also for nearly every university. And while we may hope to make every such department a centre of investigation also, it is true now, and it must always be true that in our educational institutions the teaching of the science must be the primary object of every one of its scientific departments. So the future will call for much more of definiteness as to the content and sequence of the science, as well as the manner of its presentation; its pedagogics, if you please.

The college and university departments of botany in the near future will arrive at a clearer notion as to the essentials of the science as a subject of study. It seems to one who carefully looks over the field that there is often only the most vague notion of the relative importance of the known facts in regard to plants, those of trivial importance receiving as much weight, perhaps, as those of profound significance. Especially is this true of the more elementary courses, in which there is also the greatest diversity in the presentation of the subject matter. This condition argues incompleteness of knowledge either as to the science as a whole, or as to its pedagogics. We have all heard the excusatory remark that "it makes little difference how or where we begin the study of plants, and in what sequence we pursue it." Yet none of us would admit such a contention in regard to any other matter. The more we know of a country, the more definite are our ideas as to what are its more important mountains, rivers, cities and institutions, and it is these that we feel the traveler should see. We particularize when we know; we generalize, and are vague, when we do not. It should not be long until this vagueness and doubtfulness as to substance and manner in the presentation of botany in the high school, and in the college, and in the university, will be a thing of the past. In the near future we shall certainly have the lower work clearly defined, as it is in mathematics and language, and on this the higher work will be based, to the great saving of the time and energy of teacher and student, now needlessly wasted. And I appeal to you, botanists, to take up seriously the task of so arranging and co-ordinating our work that botany shall no longer suffer the reproach of being the most chaotic of the primary sciences. Do not tell me that we can not agree. *We must agree.* If we

know our science sufficiently well we can easily discern the more important parts. Let him whose knowledge is too limited to enable him to see over the whole field step aside. Let him who has no adequate perception of the pedagogical aspects of the problem step aside. Then let the select few make a pronouncement, subject to periodical revision. This is the way that scientific men should settle the question. This is the way it will be settled some day, in the not very distant future.

The Botanical Stations.—But the college and university departments are by no means all that are engaged in botanical work. Within the past twenty-five years many stations have arisen in which botanical investigations are made. Under various local names they are in fact "investigation stations" and while their results have not been uniformly reliable it is a most hopeful sign of progress that they exist at all. Foremost among these are the fifty or more agricultural experiment stations to which I have already briefly referred, with assured support from the states and the national government for all time to come, in which botanical investigation forms no inconsiderable part of the work undertaken. Hampered as they generally were in their earlier years by incompetent direction, and often by still more incompetent workers, it is gratifying to know that year by year there has been marked improvement in both, and that now many of the directors are men of such scientific training that they wisely use the means at their disposal for investigations of permanent scientific value. And if I read aright the tendencies in these stations, it will not be long until their scientific output will be wholly reliable, as indeed it is now in some cases. This condition will be fully realized when these stations are wholly under the direction of men of broad scientific training.

And here again we have a duty to perform. We must recognize the agricultural experiment stations as permanent parts of the botanical equipment of the country. They will be with us in the future, and their results will continue to be added to botanical knowledge. We must accept them as a part of our scientific equipment, and help to make them more efficient. It will not do for us to stand aloof, and decry their results as not accurate, and as agricultural instead of botanical. When we fully realize that we have in these experiment stations so many institutions of endowed research, we shall not hesitate to welcome them to the ranks of

science. The fact that these researches in regard to plants so often have an economic purpose does not lessen the value of the results to the botanist of broad training and sympathies. Here again we must remember that as botanists we should not undervalue those contributions to knowledge in which we happen not to have an immediate interest. My scriptural quotation of a few minutes ago might well be repeated here: "the eye can not say to the hand 'I have no need of thee,' or again the head to the feet 'I have no need of you.'" When they receive the hearty co-operation of the botanists of the country the agricultural experiment stations will develop into centres of investigation of the greatest importance to science.

Already we have stations for the study of plants under particular environments, as our seaside stations, our mountain stations and a single desert station. I take it that these are suggestive of what are to come in the future. Instead of trying to make seaside conditions away from the sea, we go to the sea and there set up our laboratories. So when we want to know how plants behave in the desert we go to the desert. And this is no doubt to be the direction of botanical investigation. We are going to study plants under their natural environment, and to the seaside laboratories we shall add (as indeed we have already to a limited extent) lakeside laboratories, riverside laboratories, swamp laboratories, forest laboratories, field laboratories. Already the tropical laboratories, in Java, Ceylon and Jamaica have justified themselves, and no doubt to these we shall soon add arctic and tundra laboratories. All this signifies that more and more we are going to see what the plant is doing in its natural environment, and then we can undertake intelligently to watch it under a changed environment. So the future is to witness a great increase in the number of these laboratories, and how far it will go can only be conjectured. It now appears probable that eventually every botanical department will have one or more of these environmental laboratories in which work may be done by advanced students. They will take the students out of doors, as the old-time systematic botany took them out, but these students will go equipped with thermometers, psychrometers, anemometers and balances, instead of vascula and plant presses. Thus we shall again go afield, but on what a different quest! The old-time botanist in the field was mainly concerned with the question of the specific identity of each plant he found;

the botanist afield in the future will ask what the plants are doing under this or that environment. He will not neglect the earlier question, in fact he must have that answered, but that answered he has still his main question before him. The work in the field laboratories must necessarily be of the kind now called ecological, and so as I see it the botany of the future will have much more of ecology than is common to-day.

Yet when we think of these botanical stations whose laboratories are taken afield, as it were, we must not suppose for a moment that the old-time laboratories on the university campus are to be abandoned. Far from it. As the work in the field laboratories is enlarged there will be still greater need of the far more exact work that can be done only in laboratories where every factor can be perfectly controlled. There will still be need, greater need I might say, for perfectly constructed plant-houses in which we may observe plants under controlled conditions, and where we may increase or decrease this or that factor at will. I emphasize this point because there are some who prophesy the eventual abandonment of the precision laboratory in botany, when in fact everything points to the opposite conclusion.

Another kind of station, of which we have now only the beginnings, is one which will carry the results of plant breeding into the domain of phylogeny. Of this we have now some faint suggestions, which must grow into far reaching results under the direction of men who know more of the subject than we do now. It may be that such stations will then, as now, have a strong economic bias, but this will not so narrow them as to exclude the phylogenetic aspects of the work they are doing. In such laboratories we shall be able to see how evolution has contributed to the present wonderful diversity of form and size and color and habit among related plants. Such laboratories will enable us to answer the demand formerly so often made, but less often heard now, for a demonstration of cases of actual evolution. Although such cases are well known to botanists, their occurrence has hitherto not been such as to admit of easy citation for purposes of popular demonstration. So I regard the breeding laboratories of the future as welcome additions to the means of demonstration which science will possess.

Unity of Action.—Allow me to look once more into that future which holds so much of promise for botany. I am assured as I

consider the trend of scientific thought that there will be greater unity of action among the botanists of the country. At present we are still in the guerrilla stage of botany, in which every man acts independently and for himself. And it must be admitted that much effective work is done by guerrillas in war and in science, but in both there is far too much waste of energy. Let me pause a moment to explain more fully what I mean by this guerrilla condition in botany. Although we profess to be botanists acting for the best interests of science, we have actually no uniform standard by which we may measure our actions. In one particular we have tried to set up a standard, in certain international rules pertaining to nomenclature: and yet after several congresses of botanists we have the humiliating spectacle of a set of laws that nearly everybody disobeys! In other matters also, every man does as he pleases; and the worst of it is that he vehemently defends this free, untrammeled mode of action. We have been guerillas so long that we resent the suggestion of conformity to any regulation.

Brethren of the ancient order of botanists, this is scientifically quite unseemly. We must cease this personally independent, but disorderly life, and enroll ourselves in the regular army as good soldiers who will obey orders, and who will act in unison for the common good. And this is no illusory vision. It is one of the things that the future will bring us, yes, I may say, is bringing us. For already we find the beginnings of a reduction of some of the disorder in certain fields of work. In the management of the work of the agricultural experiment stations there are hopeful signs of a healthy progress. Certain officers in Washington, having general supervision over the stations, seeing that there is much useless duplication, have begun suggesting more harmonious planning, one station to emphasize this line of investigation, and another that line, instead of working quite independently of one another. This beginning is suggestive of what might and should be done elsewhere.

And we shall not confine unification and co-ordination to investigation alone, but will carry it into the teaching departments. As a matter of course the more general aspects of the science must find place in every college department of botany, requiring to this extent the quite legitimate duplication of the best laboratory and other facilities that can be provided. But beyond this the duplication should cease, especially of facilities that are costly in installa-

tion and maintenance. When we fully reach a condition of scientific sanity we shall agree upon such a program as will assign particular fields of work to those institutions that are best able to care for them, and it follows that students will be sent to these for such specialties. In the case of the state institutions there is already the beginning of the attempt to reduce needless duplication —in some instances crudely and awkwardly, it is true—but the significant thing is that there is already an attempt to reduce duplication. Which suggests that "the children of this world are in their generation wiser than the children of light."

This is not the place for the discussion of the details of the educational co-operation which is coming—a co-operation which will result in a conservation of educational energy. As the details are needed they will be worked out, but I may be permitted to suggest that in the near future we shall reach a solution something like the following:

(*a*) That the small colleges shall provide a standard course in general botany, with adequate facilities as to material and apparatus.

(*b*) That the larger colleges and universities shall provide an identical standard course for those of its students who have not pursued this subject in the small colleges, and to this they will add certain advanced, also standardized, courses, requiring facilities beyond the reach of the small colleges.

(*c*) Then will come, especially in the state-supported schools, such advanced courses as are required by the nature of the institutions, and the needs of each particular state; as the study of useful plants, noxious plants, local systematic botany, dendrology, pathology, etc.

(*d*) Last will come a division of labor with regard to the more profound lines of research and teaching. Certain favored institutions will place especial emphasis upon minute anatomy (cytology and histology), or special morphology, or physiology, or plant breeding, or ecology, or phytogeography, or special taxonomy, or general and experimental evolution, or botanical history, etc.

These suggestions are not chimerical. They are indicated by the recent trend of scientific thought, which recognizes more and more the value of the conservation of human effort. And as I look into the future a vision rises before me of the scientific army,

working harmoniously like well-drilled soldiers, and not wasting their strength by turning their guns on one another. In this army of science I see a company of thoroughly disciplined botanists who in orderly fashion plan their campaign. And, from the many doing severe garrison duty in the small colleges, to the heavy artillerymen in the big university fortifications, and the few isolated scouts along the frontier of special investigation, all are actuated by a common spirit of scientific patriotism and loyalty.

This, my botanical brothers, is what the future is bringing us—a united, harmonious body of trained men, whose endeavor is to carry forward the banner of science, not for personal advantage, but for the glory of the science to which we have dedicated our lives.

ABSTRACTS OF SOME PAPERS READ AT THE MEETINGS OF THE PENNSYLVANIA AND NEW JERSEY PHARMACEUTICAL ASSOCIATIONS FOR 1912.

By John K. Thum, Ph.G., Pharmacist at German Hospital.

An Improved Formula for Mistura Rhei et Sodæ.

By Adolph F. Marquier.

The writer states that the present official formula for Rhubarb and Soda Mixture makes a preparation which is too sweet because of the large amount of glycerin present and that the essence of peppermint could be reduced with decided advantage. He suggests the following formula:

Sodium bicarbonate	35.0 Gm.
Potassium carbonate	3.0 Gm.
Fluidextract rhubarb	15.0 c.c.
Fluidextract ipecac	3.0 c.c.
Spirits peppermint	15.0 c.c.
Alcohol	100.0 c.c.
Glycerin	250.0 c.c.
Water to make	1000.0 c.c.

Mix and filter.

From Proc. N. J. Pharm. Assoc.

The Determination of Glycerin in Suppositories.

By Chas. E. Vanderkleed and Fritz Heidlberg.

In determining the amount of glycerin in suppositories the authors adopted a method which is based upon Hehner's bichromate method for the estimation of glycerin:

Half of a suppository—about 2 grams—is dissolved in a separator with hot water acidified with sulphuric acid and shaken out with ether, thereby separating the stearic acid. The aqueous solution is evaporated to a small volume which drives off all the ether; the solution is then transferred to a 250 c.c. volumetric flask and filled to the mark with water.

Twenty-five c.c. of the filtered solution is measured into a 250 c.c. volumetric flask, 35 c.c. of potassium bichromate solution is added, and lastly 25 c.c. of strong sulphuric acid is added slowly with constant rotation to avoid ebullition. The flask is then transferred to a boiling water-bath for 20 minutes, cooled, and filled to the mark. In 25 c.c. of this solution the excess of bichromate is determined by adding 20 c.c. of potassium iodide T. S. and titrating against approximately N–10 sodium thiosulphate solution, the factor of which toward the potassium bichromate solution has been determined previously. Calculate the amount of potassium bichromate which has been used to oxidize the glycerin to CO_2. One c.c. of potassium bichromate is equivalent to 0.01 glycerin.

The bichromate solution is made by dissolving 74.615 grams recrystallized potassium bichromate in distilled water, adding 150 c.c. sulphuric acid and making up the volume to 1000 c.c. at 20° C.

With some modification the same method was used to determine glycerin in a mixture of potassium chlorate, chalk, phenol, soap, and essential oils, as they occurred in a toothpaste.

From Proc. Penn. Pharm. Assoc.

Aqua Caryophylli.

By Milton Dunn.

The author states that the Elixir Digestivum Compositum, and various elixirs of lactated pepsin on the market, are used principally as vehicles and as such are not satisfactory, notwithstanding all that has been done to make them popular with physicians.

He suggests the following formula for a clove water, stating that it meets all possible requirements as a vehicle and is particularly efficient for the administration of bromides and iodides.

Oil of cloves	4.0 c.c.
Tincture of cudbear	50.0 c.c.
Alcohol	43.0 c.c.
Purified talc	15.0 gm.
Water to make	1000.0 c.c.

Mix and filter.

From Proc. Penn. Pharm. Assoc.

SAFFRON.

By R. I. GRANTHAM.

Because of its excessively high price saffron is frequently found on the market adulterated in many ways.

Among the methods practised for this purpose the author mentions the mixing with vegetable filaments, coloring with aniline dyes, and by adding articles of high specific gravity, such as glycerin, molasses, honey, and salts of sodium and potassium, as well as barium sulphate to increase its weight.

The author gives the result of some tests on 4 samples to determine the presence of added coloring matter of aniline origin. The results so far as color from this source is concerned were negative.

From Proc. Penn. Pharm. Assoc.

LABORATORY NOTES.

By THOMAS A. EGAN.

Commenting on the manufacture of zinc oxide ointment the author recommends that the zinc oxide be triturated in a mortar with 10 per cent. of oil of benne until perfectly smooth, then melt the lard, add to contents of mortar and stir continuously until mixture becomes firm. By this method an ointment is obtained which remains smooth and does not become granular with age.

Discussing the time-honored Basham's mixture, he remarks that the varying temperature of the store is the source of trouble with this preparation, as it favors chemical change. He replaces part of the water used in making this preparation with orange flower water and keeps it in the refrigerator.

Claiming that if kept 10 feet below the surface of the ground it acquires an aroma equal to imported cologne water, he gives the following formula for its manufacture:

Oil of bergamot	6 drachms
Oil of lemon	7 drachms
Oil of lavender flowers	5 drachms
Oil of rosemary	50 drops
Oil of rose	8 drops
Oil of cloves	13 drops
Oil of neroli	10 drops
Tincture of musk	10 drops
Cologne spirits	56 ounces
Orange flower water	8 ounces
Powdered sandalwood	1 drachm

From Proc. Penn. Pharm. Assoc.

Deterioration of Syrup of Wild Cherry.

By J. Graham French.

The author gives the method of determination and results in a series of experiments to determine just how long after date of manufacture the hydrocyanic acid in syrup of wild cherry disappears.

Three lots of syrup were prepared and tested. In each case about 10 c.c. was distilled by passing live steam into the syrup. To the distillate was added a mixture of ferric chloride and ferrous sulphate, the latter being in excess. The solution was then made alkaline with sodium hydrate solution and the precipitate formed dissolved by the addition of hydrochloric acid. A blue or green color was taken as an indication of the presence of hydrocyanic acid.

He says that he feels justified in stating that the acid disappears within 3 or 4 months after date of preparation.

From Proc. Penn. Pharm. Assoc.

How Should Retail Druggists Keep Leeches?

By W. A. Pearson.

The author endeavored to determine whether leeches would be longer-lived kept in a jar covered with cheese cloth, containing 200 grammes of animal charcoal and 1000 c.c. of water, or the orthodox way of a tin can, with moist earth.

He gives the results of a series of tests and states that he feels justified in recommending the charcoal-water method of keeping leeches because the odors from which leeches die are largely absorbed by the charcoal, insects cannot be attracted to the dead leeches, the leeches can easily be caught by pouring the mixture through a coarse sieve, and dead ones can readily be removed in the same manner.

From Proc. Penn. Pharm. Assoc.

The Purity of Gelatin.

By J. G. Roberts.

The author's attention having been brought to a report in foreign journals that arsenic had been found in excessive amounts in gelatin of German manufacture, he deemed it worthy of investigation, and accordingly several brands found on the market were examined. The presence of arsenic is explained by the fact that hides and trimmings used in the manufacture of gelatin had been treated with an arsenic solution during the process of curing.

As gelatin is of much use for household and pharmaceutical purposes its purity is of some importance.

Arsenic in quantities greater than one part in a million was found in two samples of German manufacture. Samples made in Belgium, one from Austria, and two samples of ground gelatin of domestic manufacture contained no arsenic, while two others of domestic manufacture contained only traces.

In order to extract the arsenic the author subjected the gelatin to special treatment in order to change it into a soluble form and obtain a sufficient quantity of arsenic to get a distinct reaction. Twenty grams were heated in an evaporating dish with 35 c.c. of arsenic-free sulphuric acid until a dried, charred mass remained. Fifteen cubic centimetres of nitric acid was then added in small portions while heating cautiously, and the heating continued until the excess of acid was expelled and the residue dry. Residue was then extracted with 30 c.c. of hot water, the solution filtered and Marsh's test applied in the usual way.

From Proc. Penn. Pharm. Assoc.

ELEVENTH INTERNATIONAL PHARMACEUTICAL CONGRESS.

The Eleventh International Pharmaceutical Congress, under the august patronage of his Royal Highness, Prince Henry of the Netherlands, will be held at the Hague from September 17th to the 21st, 1913. This has been organized and developed primarily under the auspices of the Netherland Pharmaceutical Society with the following Executive Committee:

General President: Prof. Dr. L. van Itallie, Leyden; *Vice-Presidents:* Dr. H. L. Visser, Nijmegen, President of the first section, General Subjects; Prof. P. van der Wielen, Amsterdam, President of the second section, Galenical Pharmacy; Prof. Dr. N. Schoorl, Utrecht, President of the third section, Chemistry; Dr. J. Dekker, Haarlem, President of the fourth section, Botany and Materia Medica, and Prof. Dr. H. P. Wijsman, Utrecht, President of the fifth section, Bromatology. *General Secretary:* J. J. Hofman, The Hague, 4, Schenkweg, The Hague. *Members:* G. H. van der Wal, The Hague, General Treasurer; Dr. J. F. Suyver, Amsterdam, and Miss A. Grutterink, Pharm. Dr., Rotterdam.

Regulations of the Eleventh International Pharmaceutical Congress.

Date and Place.—1. The eleventh International Pharmaceutical Congress, organized by the "Nederl. Maatschappij tot bevordering der Pharmacie" (Netherland Pharmaceutical Society) will be held at The Hague—Scheveningen in the month of September, 1913.

Committees.—2. A Committee is charged with the organization of the Congress.

This Organizing Committee chooses from its members an executive committee which will consist of: a General President, 5 Vice-Presidents (presidents of the sections), a General Secretary and an Assistant-Secretary, a Treasurer, and one member.

The Council of the committee will consist of: the general president, the general secretary, and the general treasurer.

In agreement with the Council, the vice-presidents arrange all matters pertaining to their sections, and appoint the committees with their secretaries for these sections.

The executive committees will have the power to appoint special

committees, as may be necessary for making arrangements for the reception of the members of the congress with their ladies, and for other purposes.

Members.—3. Any person interested in one of the subjects mentioned in Art. 7 of these regulations, may become a member of this Congress.

4. The members are divided into:

Patrons, ordinary members, and extraordinary members.

Contributions.—Patrons pay a minimum contribution of 25 guilders (£2. 1 sh.) to defray the expenses of the Congress.

The contribution of ordinary members is fixed at 10 guilders (16 sh. 8 d.). They send in their applications to the General Secretary of the Congress.

Rights of the Members.—Patrons and ordinary members of the Congress may attend all the meetings festivities, and excursions of the Congress, they have a vote, and receive the reports and other printed publications of the congress.

The ladies or the members of the families of the patrons and ordinary members of the Congress may become extraordinary members by paying a contribution of 5 guilders (8 sh. 4 d.) They may attend the meetings of the congress, but have no vote. They are invited to the different festivities or excursions, organized by the Committee. They do not receive any reports or printed publications.

Membership of Societies.—5. A Society, represented by one or more of its members, can also be accepted as a patron or ordinary member. In this case the contribution due, is to be paid for each representative.

Subjects.—6. All patrons and ordinary members have a right to contribute a scientific paper to the Congress, and to discuss a subject or introduce one for discussion.

Sections.—7. The Congress is divided into 5 sections:

1. General Subjects. Legislation. Organization. History of Pharmacy. Education. Training. Military Pharmacy.
2. Galenical Pharmacy. Pharmaceutical preparations. Art of dispensing. Technics.
3. Chemistry.
   a. Preparation and examination of medicinal products. Analytical Chemistry.

b. Toxicology, Physiological and Pathological methods of examination.

4. Botany and Materia Medica. Pharmacognosy. Examination of drugs. Bacteriology.

5. Bromatology. Examination of foods. Institution of a Board of Inspection for foodstuffs.

Languages.—8. The official languages of the Congress are Dutch, French, English, German.

Reports.—The reports will be written in French. The papers and publications which are sent in, may be written in any of the above-mentioned languages; but, if required, an abridged report written in French, will be added.

9. The committees of the Congress also have a right to publish the reports and communications which have not been discussed in the meetings of the Congress.

Meetings.—10. There will be general and sectional meetings.

At least two general meetings will be held. The dates and the lists of subjects will be fixed by the organizing committee. The sections will meet as often as is considered necessary, and they will be independent as to the arrangement of their work.

11. At the end of each sectional meeting the secretary will hand over to the general secretary the text of the subjects treated, of the proposals, and of the resolutions carried by the meeting. The report of the meeting must reach the general secretary before the next meeting of his section is held.

The Council of the Congress.—12. The first general meeting will be presided over by the general president of the organizing committee. In this meeting the following members will be appointed: the general president of the Congress, 5 vice-presidents (presidents of the sections), the honorary vice-president of the Congress, the honorary sectional presidents, the general secretary, the treasurer, and the assistant secretaries.

The Next Congress.—13. In the last general meeting it will be decided when and where the Twelfth International Congress will be held.

Sectional Meetings.—14. The first sectional meetings will be presided over by the presidents appointed for this purpose.

In these first sectional meetings the sectional committee will be chosen.

Votes.—15. All resolutions of the general as well as of the sectional meetings are carried by a majority of votes.

16. Without the president's consent, nobody is allowed to speak for more than two periods of 5 minutes during the debate.

Reports.—17. The reports of the meetings will contain: *a.* A list of the subjects treated, the names of the speakers, and an abridged report of the debate. *b.* Resolutions carried by the meeting.

18. In order to ensure the exact wording of the report, every speaker is requested to give an abridged report of his speech to the secretary within half an hour after the meeting is adjourned. It is preferred that this report be written in French, but it may also be written in any other of the above-mentioned languages. The sectional secretary gives these reports, together with a list of the members who have been present at the meeting, to the general secretary.

19. The resolutions of an international character will be communicated to the governments by the Committee of the Fédération Internationale Pharmaceutique.

20. A general report of the Congress will be sent to the patrons and ordinary members.

All documents and other reports of the congress will be handed over to the Fédération Internationale Pharmaceutique when the Congress is finished.

Archives and Reports of the Committees.—21. The reports of the committees, appointed by this Congress, will be handed over to the Fédération Internationale Pharmaceutique, which, together with the Council of this Congress, is entrusted with the winding up of current affairs.

22. The Council of the Congress will decide any subject which is not treated of in these regulations.

Program of the Sections.

SECTION I: GENERAL SUBJECTS.

Committee: Dr. H. L. Visser, President, Dr. W. v. d. Slooten, Secretary, J. van Riel, and Dr. L. M. v. d. Berg.

Subjects Introduced for Discussion.

1. The different systems of practising Pharmacy, their advantages and disadvantages. (Concession, free establishment, State or municipal pharmacies.)

2. Is it desirable to limit the sale of pharmaceutical specialities exclusively to the pharmacists? In what manner can these specialities be defined and how can the sale be regulated by act of Parliament?

3. The supply of medicines in rural districts.

4. International arrangement of the pharmaceutical nomenclature.

5. National and local organizations of chemists.

6. International trade in pharmaceutical specialities.

7. Pharmaceutical education in different countries.

8. The assistants in dispensaries. The advantages and disadvantages of assistants, who do not possess a chemist's diploma and cannot obtain one.

9. The military pharmacist working in behalf of hygiene and of the chemical and technical service.

10. What measures can be taken to enforce the observance of laws regulating pharmacy?

11. The training of and the requirements for the analytical assistants in pharmaceutical and chemical laboratories.

12. Free treatises on the subject of historical pharmacy.

SECTION 2: GALENICAL PHARMACY.

Committee: Prof. P. van der Wielen, President, E. S. van Itallie, Secretary, Miss C. H. Hugenholtz, and Dr. J. S. Meulenhoff.

Subjects Introduced for Discussion.

1. International standards should be made concerning the value of those medicines for which international requirements concerning quality exist.

2. Preparation of galenicals by hand is a necessary preparation in wholesale laboratories. It is possible only if there is a proper and responsible control over the materials and the methods of preparation.

3. The preparation of aromatic waters.

4. Is it desirable to adopt a uniform method of expressing alcoholic strength in percentage by weight?

5. When a medicine has to be reduced to its proper strength by dilution, a limit should be established for the quantity of the neutral diluent to be added.

6. The establishment of a minimum limit for the active strength of medicines without establishing also a maximum limit, is wrong.

7. How does cultivation influence the activity of vegetable drugs?

8. Has the presence of oxydases in the materials any influence on the quality of galenicals?

9. Is it possible and desirable to give in the official regulations physiological as well as chemical methods for the analysis of galenicals?

10. Can it be justified that regulations or requirements for medicines should be changed on other than medical grounds?

11. A uniform international agreement for establishing uniform methods in the preparation of galenicals should be made after a comparative examination of the various processes.

SECTION 3: CHEMISTRY.

Committee: Prof. Dr. N. Schoorl, President, W. C. de Graaff, Secretary, Prof. Dr. P. van Romburgh, Prof. Dr. G. Hondius Boldingh, Dr. P. C. Meerburg, Dr. W. E. Ringer, Dr. D. J. Hissink, Dr. A. Robertson, and J. W. de Waal.

Subjects Introduced for Discussion.

1. In how far would it be possible to shorten the chemical monographs of the Pharmacopœia in a reasonable way?

2. What requirements should be established for the quality of the glass used in pharmacy?

3. Codification of the requirements of purity necessary for chemicals.

4. Unification of the so-called standard-solutions; also with respect to their preparation, preservation, and purity.

5. The influence of the metals lead, zinc, tin, copper, nickel, and aluminium on water.

6. Comparative examination of the methods for measuring the hardness of water.

7. Comparative examination of the qualitative and quantitative methods of testing pepsin, trypsin, and other proteolytic or peptolytic ferments.

8. Is the action of pepsin identical to that of chimosin or not?

9. The occurrence, the significance, and the tracing of ferments in animal excreta.

10. The conduct of albuminoids in an aqueous solution by the side of salts, and in connection with the reaction of the medium.

11. The desirability and possibility of a codification of clinical and chemical methods of analysis.

12. A critical examination of the reliability of the formol-titration of ammonia, aminic acids, and albuminous products in urine.

13. How can lævulose be definitely identified in urine? And is it due to the alkaline reaction of the blood?

14. In what forms can uric acid (and uric salts) be precipitated from a solution?

15. The significance and the method of chemical analysis of sweat.

16. The formation of oxalic acid in animal and vegetable organisms.

17. The toxicity of methyl alcohol.

18. The rational analysis (quantitative) of the inorganic elements in animal and vegetable organs and products.

19. Critical and experimental discussion of the methods for the destruction of organic materials in toxicological analysis.

20. Comparative examination of the different methods for estimating protoxyde of potassium in manure.

21. The non-nitrogeneous extractive materials of different foods.

22. Comparative examination of the different methods of estimating phosphoric acid in manure.

23. Analysis of and requirements necessary for potassium-phosphate as a food for animals and as a medicine.

24. The rational methods of sampling for the analysis of materials in connection with the accuracy of the analysis.

25. The injurious forms of arsenic in wall-paper and their quantitative determination.

26. The toxicity of nickel-salts in connection with the use of nickel kitchen utensils.

27. The estimation of the quantity of sand in foods for men and animals.

SECTION 4: BOTANY AND MATERIA MEDICA.

Committee: Dr. J. Dekker, President, Dr. H. W. Nijdam, Secretary, Prof. Dr. C. van Wisselingh, Prof. Dr. E. Verschaffelt, and L. H. van Berk.

Subjects Introduced for Discussion.

1. The quantitative estimation of quinine and other alkaloids in cinchona-bark.

2. What is the significance of the "pyro-analysis" for the examination of drugs?

3. The estimation of the value of coca-leaf.

4. The importance of bacteriology to students of Pharmacy.

5. What is the function of hydro-cyanogen in the organism of plants?

6. Quantitative investigations about the influence of poisonous materials on plants.

7. In how far do chemical data assist the botanist in systematic classification of the different kinds of plants?

8. What are the functions of tannin in the vegetable organism?

9. The function of latex in Hevea Brasiliensis and other plants producing india-rubber.

10. The occurrence of saponins in the vegetable kingdom.

11. The physiological measurement of the value of Folio digitalis, Semen strophanthi, etc.

12. The influence of enzymes on the activity of drugs, during collection and drying.

SECTION 5: BROMATOLOGY.

Committee: Prof. Dr. H. P. Wijsman, President, Dr. A. Lam, Vice-President, and Dr. A. van Raalte, Secretary.

1st Subsection: Chemistry of Foods: Dr. A. Lam, President, Dr. J. D. Filippo, Dr. H. van Gulik, Dr. G. Romijn, Dr. J. J. van Eck, Dr. F. H. van der Laan, Dr. A. J. Swaving, and Dr. G. Voerman.

2nd Subsection: Biology of Foods Prof. Dr. G. van Iterson, Jr., President, Prof. Dr. C. Eykman, Dr. Ch. Ali Cohen, Dr. C. W. Broers, F. F. Bruijning, Jr., and B. A. van Ketel.

Subjects Introduced for Discussion in the Meeting of the Complete Section.

1. Which is to be preferred: to make up lists of colouring materials and preservatives, the use of which is permitted to the exclusion of all others; or to make up lists of prohibited colouring materials and preservatives?

2. The influence of government control on the price of foods.

3. Quantitative determination of sugar in jams, etc., by means of chemical and biological methods.

4. The analysis of drinking-water in places near the sea coast and, in general, in places with a saline soil.

5. Description of the ideal "baby-food."

6. The grading of flour according to different methods, for in-

stance by a microscopic measurement of the bran; comparison of their value.

7. The growing stale of bread.

8. Should foods which under certain circumstances produce prussic acid be allowed for consumption?

9. Foaming-materials in lemonade.

10. Examination of enamelled kitchen utensils.

11. Methyl alcohol in beverages.

12. Protection of food against insects.

13. Dangers of tuck-shops and of sweetmeats.

Subjects Introduced for Discussion in the Chemical Subsection.

1. The application of colorimetry in the analysis of food.

2. The importance of refractometry in the chemistry of foods.

3. To ascertain the adulteration of milk by means of the freezing point method and the serum method of Ackerman.

4. The use of new vegetable fats in the margarine-industry.

5. Rational classification of cheese according to the quantity of fat it contains.

6. Influence of the chemical composition of butter-fat on the consistency and the qualities of the butter, also in connection with the composition of the milk.

7. Controlling the pasteurisation of milk by non-bacteriological methods.

8. The minimum amount of fat in cocoa-powder.

9. Direct chemical measurement of fecula.

10. The bleaching of flour.

11. Components of the fermentation products obtained from other juices than grape- or apple-juice.

12. The detection of organic poisons (toxins and the like) in food.

13. Denaturation of alcohol.

14. Estimation of manganese in drinking-water.

15. Analysis of mineral and medicinal waters.

16. The amount of fibrous substance in cocoa and chocolate.

Subjects Introduced for Discussion in the Biological Subsection.

1. Biological analysis of drinking-water.

2. The significance of other components of foodstuffs than albumen, fat, and hydrocarbon.

3. Serum reactions in the analysis of food.

4. Correlation between the morphological qualities of corn and the baking value of flour.

5. Microscopical analysis of bread.

6. Statistical method of describing articles of food; especially fecula.

7. Physico-chemical and biological analysis of milk, in connection with certain forms of disease of cattle.

8. Direct microscopical counting of bacteria in drinking-water.

9. Coli bacilli in pasteurised milk and in water.

10. Bacteriological analysis of prepared meat foods.

11. The value and the analysis of yoghurt, maya, and other preparations of the kind.

12. Maturing processes in cheese.

13. Colonial alcoholic fermentation products (arrack, rhum, etc.).

14. Examination of oysters.

15. Sterilisation by means of ultra violet rays.

16. The connection between food commodities and infection.

GENERAL INFORMATION.

Secretary's Office and Inquiry Office.

The Congress will be held at the Kurhaus, Scheveningen.

The General Secretary's office and the inquiry office at the Kurhaus will be open from September 16th until September 21, 1913, from 9 A.M. to 6 P.M.

For the members of the Congress a special Post and Telegraph Office will be established in one of the wings of the Kurhaus near the Secretary's Office.

Obtainable at the Inquiry Office:

1. Member's tickets for the congress and badges.

2. All official communications and reports concerning the congress.

3. Tickets for the congress dinner.

4. Tickets for excursions and for the different museums, amusements, etc.

Messrs. Lissone and Son's Office will place one of their officials at the disposal of the members in order to give any information wanted and to compose circular tickets for the railways.

Meetings of the Sections.

These will be held on the 18th of September in the various laboratories of the Leyden University.

About the Sending in of Reports for the Congress.

1. All reports and contributions for the Congress should be sent, in legible writing (by preference in duplicate and type-written) to the general secretary of the Congress before June 1st, 1913.

2. They should be written on one side of the paper only.

3. To all reports must be added:

   1. The conclusion the report arrives at.
   2. A concise survey of the report, preferably written in French.

4. All reports and documents that reach the general secretary before the 1st of June, will be printed beforehand, and sent to the members of the Congress by request; they can be obtained at the general secretary's office before the opening of the Congress. Papers that come in after that date, will appear in an appendix, but the general secretary cannot guarantee their publication in time for the opening of the Congress.

5. All reports, papers, etc., must be accompanied by the writer's name and full address.

6. All contributions must be original; they must not have been published elsewhere.

7. The contributors must conform to the resolutions of the Committee of the Congress concerning the publication of their reports.

8. After the appearance of the reports, papers, etc., in the Congress-report, and in any case after the 31st of December, 1913, the members will be at liberty to publish their reports and communications elsewhere.

9. All contributors will receive 50 copies of their reports and additional copies will be obtainable at cost price.

10. The Committee of the Congress has a right to refuse reports and communications which are not considered suitable for discussion at this Congress or which are of a too strong personal character, or might cause a too violent debate, or serve as a means of advertisement.

11. If the reports are too lengthy the Committee may resolve to publish an abstract only.

12. For the explanation of a report, only ten minutes can be allowed at the meeting.

13. In case of the writer's absence, only the title of the report will be made known, while the discussion will be held from the printed papers.

14. Those who take part in the discussion will be given an opportunity to communicate their remarks briefly to the secretary.

Travelling Accommodation.

The Holland-America Line will reserve better class cabins at minimum saloon (1st class) fares for visitors of the Congress who leave New-York on board one of their steamers after August 10th, and return after October 18th. These minimum fares are for ss. "Rotterdam" 107.5 dollars; for ss. "Nieuw-Amsterdam" 95 dollars; for the other steamers 85 dollars.

The Batavier Line Rotterdam—London will give a 10 per cent. reduction on their fares to members of the Congress.

The Royal Holland Lloyd will reserve better class cabins at minimum saloon (1st class) fares for members of the Congress leaving South-America after August 15th, and returning after October 1st.

The Royal West-Indian Mail Service draw special attention to their excursion tickets, return fare for six months, 450 guilders (£37. 10sh. od.). These are issued at Paramaribo and Trinidad. Moreover, the Company give a 15 per cent. reduction on first-class return tickets from Venezuela, Curaçao, Haiti.

Lissone and Son's Office will give the necessary information about ordinary and circular trips through Holland which members may wish to take after the Congress is finished.

Members of the Committee of the Congress will meet all international expresses arriving at The Hague on September 16th and 17th at the Holland Railway and State Railway stations, in order to give any information required.

Hotels.

The "Maatschappij Zeebad Scheveningen" will reserve rooms in their hotels for the members of the Congress at a uniform price of 3.25 guilders (5/5) for rooms for 1 person, and 6 guilders (10/–) for rooms for 2 persons, including breakfast and attendance.

Exhibition.

The Committee of the Congress intend to hold, in one of the halls of the Kurhaus, an exhibition of photographs and pictures of pharmacies throughout the world. Therefore, the Board will gladly receive photos, of external and internal views of pharmacies, pharmaceutical laboratories, pictures of dispensaries of former times, etc.

The Committee will also endeavor to collect a number of pictures of pharmaceutical Institutes and laboratories of Universities. Those who are willing to contribute to this exhibition are kindly requested to send their photographs, etc., to the general secretary of the Congress at The Hague.

Excursions, Receptions, and Festivities.

A programme of the excursions, receptions, and festivities in connection with this Congress, will be published in due time.

THE PHILADELPHIA COLLEGE OF PHARMACY.

Minutes of Quarterly Meeting.

The quarterly meeting of the Philadelphia College of Pharmacy was held December 30th, 1912, at 4 P.M., in the Library, with the president, Howard B. French, in the chair. Eleven members were present. The minutes of the semi-annual meeting held September 30th were read, and approved. The minutes of the Board of Trustees for September, October, and November, were read and approved.

The President announced the deaths of Miss Florence Yaple and Alexander H. Jones, both life members of the College. Miss Yaple was long associated in the work of the American Journal of Pharmacy and a biographical sketch of her is given in this Journal for November, 1912. Mr. Jones had been in the service of Powers and Weightman since boyhood.

Mr. George M. Beringer reported the death of Charles S. Braddock, of Haddonfield, N. J., which occurred on December 1st, 1912. Mr. Braddock was a graduate of the College, though not a member, and because of his long and useful career a record of his death is recorded in the transactions of the College.

The name of Professor Thomas Franz Hanausek, Ph.D., of Austria, proposed for Honorary Membership at a previous meeting, was balloted for, and unanimously elected.

The names of Sister Bertha Mueller, William Wilson Rose, and Elmer H. Hessler, previously reported for Associate Membership and approved by the Committee on Membership, were balloted for and unanimously elected.

The following communication was read:

October 7th, 1912.

PROFESSOR SADTLER.

DEAR SIR: Your letter of the first of October received. I sincerely thank you for hearty congratulations extended to me on the anniversary of my eighty-first birthday.

Very sincerely yours,

F. GUTEKUNST.

The President reappointed the Committee on Legislation: Warren H. Poley, Joseph P. Remington, William McIntyre, Theodore Campbell, William E. Lee, William L. Cliffe.

C. A. WEIDEMANN, M.D.,
Recording Secretary.

ABSTRACTS FROM THE MINUTES OF THE BOARD OF TRUSTEES.

October 1st, 1912: Fourteen members were present. The Secretary of the College reported that Aubrey H. Weightman, William E. Lee and O. W. Osterlund had been re-elected to membership in the Board.

The Committee on Property reported that the various repairs and alterations undertaken by the Committee were completed and that the College buildings were in good shape.

Committee on Library reported the purchase of a number of books during the month, and the gift of "Elements of Experimental Chemistry," by Mr. I. B. Sweitzer, of the Class of 1888.

Committee on Accounts and Audit reported they had examined the accounts of the Treasurer, Registrar and Committee of Publication and found them correct.

Professor C. B. Lowe reported that he had arranged with Doctor Robert N. Wilson to deliver a lecture to the students, and suggested procuring copies of a circular recently issued by Doctor Wilson, for distribution to the students. The request was granted.

The Committee on Scholarships reported the names of ten (10) persons as deserving of free Lecture, Laboratory and Recitation tickets for the Course beginning 1912, and recommended that the awards be granted. The recommendation was approved.

A communication was received from Mr. William Dick, Secretary of the Board of Public Education of Philadelphia, naming four persons from the Manual Training and High Schools who had been awarded scholarships in the Philadelphia College of Pharmacy. The recommendation was approved.

Committee on Examination reported that the re-examinations had been held, and reports were being received.

Athletic Committee reported a series of rules governing the Gymnasium, and of the necessity of having some one in authority present while the gymnasium was in use, and recommended engaging Mr. F. N. Moerk till the middle of March, 1913, for this purpose. This recommendation was approved.

Mr. John K. Thum was elected to active membership.

November 6th, 1912: Fourteen members were present. Special Committee on Scholarships reported several recommendations governing the Award of Scholarships, which were approved. A very extended discussion took place in reference to establishing fellowships. The matter was referred to a special committee to consider the subject.

The Committee on Library reported a number of accessions by purchase during the month, and that sixty-four persons had consulted the Library during the month.

December 3rd, 1912: Eighteen members were present, Professor F. X. Moerk being present by invitation.

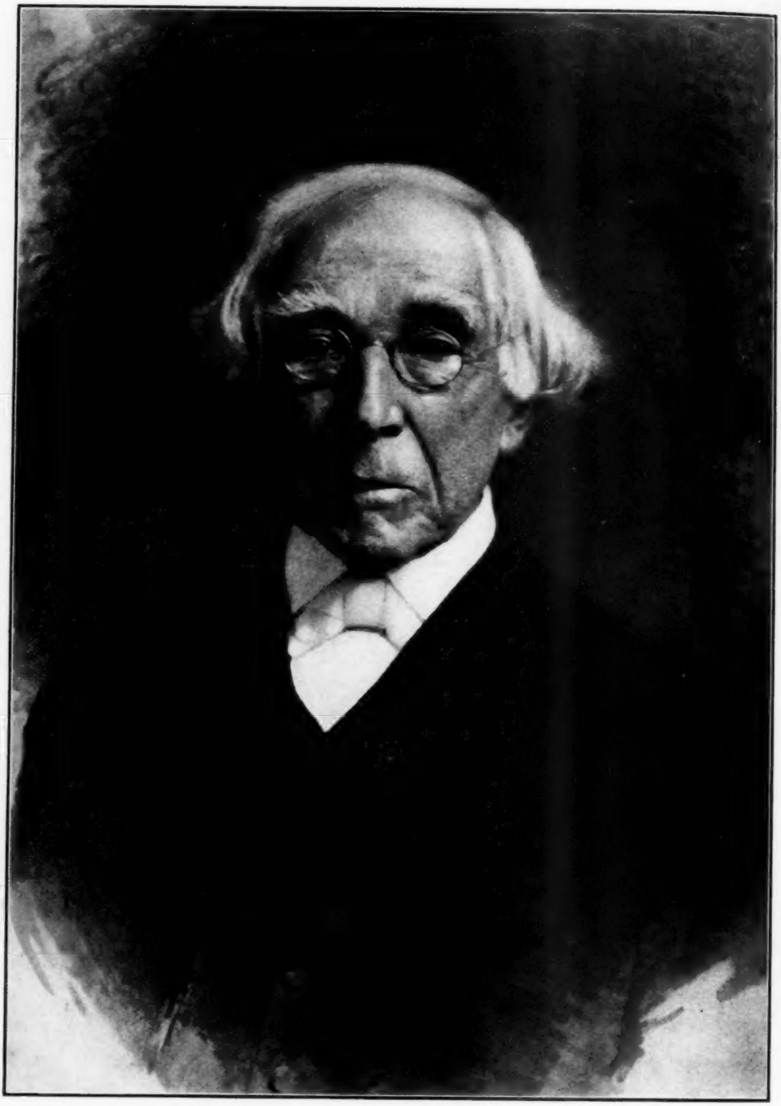
Committee on Library reported that a number of books had been procured by purchase, and one book by gift from the *Druggist's Circular*. Also that seventy-six persons had used the Library during the month.

Committee on Instruction presented a matter of importance to the College—the discussion was prolonged till the hour of adjournment—and on motion it was agreed to call a meeting of the Board for December 6th.

December 6th, 1912: Fourteen members were present, Professor Moerk being present by invitation. The Committee on Instruction presented a series of resolutions offered by Mr. French, which after discussion were adopted.

Mr. Beringer referred to the present method of advertising the College and moved that the entire matter be referred to a Special Committee, consisting of the Finance Committee and Committee on Announcement.

Professor Remington stated that Mr. C. E. Hires, a graduate of the College, had presented to the College four water coolers and would supply the drinking water free of charge. The thanks of the Board were tendered the donor.



EWEN McINTYRE, 1825–1913.